COST OF GAS

Suggested Grades

7, 8, 9

SD Mathematics Strand & Standard *(Primary for Task)*

Algebra

7.A.3.2 Model and solve multi-step problems involving rates.

Task Summary

Students will demonstrate their understanding of rates by determining the cost of gas that will use to get to a part-time job.

Time and Context of Task

After completing unit on rates, I allow two class periods for the students to work on this project. This allows them time to use the internet to find their cars, research laws for employees under the age of 16, find maps, and type up their findings.

Materials Needed

Paper, pencil, calculators

Author and Lead Teacher for this Task

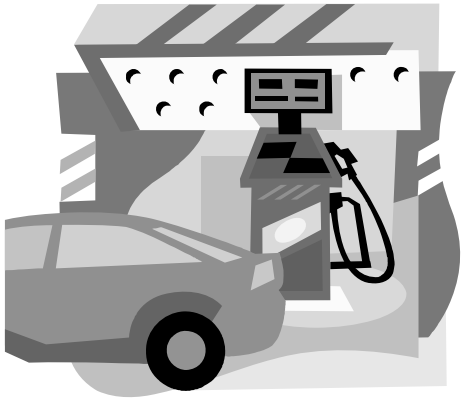
Pat Reiners
West Central Middle School, Hartford, SD

COST OF GAS

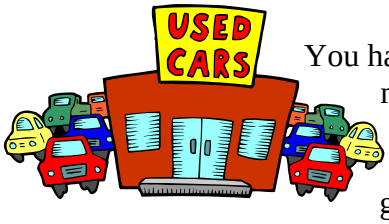
You have accepted a job at the mall working 20 hours per week for minimal wage. You may not work more than six hours in any one day. Your parents have agreed to supply you with a used car, but you have to pay for the gas from your wages. Calculate the cost of your gas for a month.

Your final report will need to include all of the following:

- Select a used car and find the estimated miles per gallon for this car.
- Find the exact distance from your home to the Mall using various routes and make a map of the route you will use. Explain why you choose this route.
- Prepare a weekly schedule showing your working times. (Remember that you are under the age of 16 and certain working conditions limit when you can work)
- Use the current cost of a gallon of gasoline to find the cost of your gas for one month.
- Find the percentage of your gross wages that will be used for gasoline.
- Explain why you made the choices you did and the mathematics you used to make these decisions.



Cost of Gas



You have accepted a job at the mall working 20 hours per week for minimal wage. Please assume that you are 14 years old. You may not work more than six hours in any one day. Your parents have agreed to supply you with a used car, but you have to pay for the gas from your wages. Calculate the cost of your gas for a month.

Your final report will need to include all of the following:

- Select a used car and find the estimated miles per gallon for this car.
- Find the exact distance from your home to the Mall using various routes and make a map of the route you will use. Explain why you choose this route.
- Prepare a weekly schedule showing your working times. (Remember that you are under the age of 16 and certain working conditions limit when you can work)
- Use the current cost of a gallon of gasoline to find the cost of your gas for one month.
- Find the percentage of your gross wages that will be used for gasoline.
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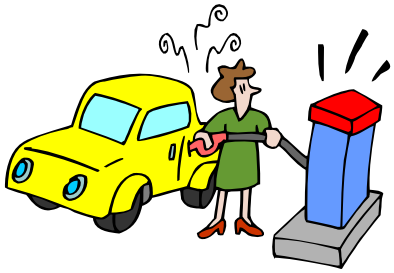


Prepare your project for presentation. The presentation format can be a booklet, poster, PowerPoint, etc.

CONTENT STANDARDS

Primary Standard

Strand Name: Algebra
SD Goal: Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities**.**
Indicator: Interpret and develop mathematical models.
Standard: 7.A.3.2 Model and solve multi-step problems involving rates.

Supplemental Standard

Strand Name: Number Sense
SD Goal: Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operations.
Indicator: Develop conjectures, predictions, or estimations to solve problems and verify or justify the results.
Standard: 7.N.3.1 Use various strategies to solve one- and two-step problems involving positive fractions and integers.

NCTM Process Standards

Problem Solving:
Build new mathematical knowledge through problem solving. Apply and adapt a variety of appropriate strategies to solve problems.

Communication:
Communicate mathematical thinking coherently and clearly to peers, teachers, and others. Use the language of mathematics to express mathematical ideas precisely.

Connections:
Recognize and apply mathematics in contexts outside of mathematics.

Problem-Solving Strategies

- Estimation and check
- Developing formulas and writing equations
- Drawing pictures, graphs, and tables
- Modeling
- Simplifying the problem
- Acting out the problem

ASSESSMENT TOOLS

Task Rubric

CATEGORY	Advanced	Proficient	Basic	Below Basic
7.A.3.2 Model and solve multi-step problems involving rates.	Explanation shows complete understanding of the mathematical concepts used to solve the rate problem(s).	Explanation shows substantial understanding of the mathematical concepts used to solve the rate problem(s).	Explanation shows some understanding of the mathematical concepts needed to solve the rate problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the rate problem(s) OR is not written.
Mathematical Reasoning	Uses complex and refined mathematical reasoning.	Uses effective mathematical reasoning	Some evidence of mathematical reasoning.	Little evidence of mathematical reasoning.
Mathematical Errors	90-100% of the steps and solutions have no mathematical errors.	Almost all (85-89%) of the steps and solutions have no mathematical errors.	Most (75-84%) of the steps and solutions have no mathematical errors.	More than 75% of the steps and solutions have mathematical errors.
Explanation	Explanation is detailed and clear.	Explanation is clear.	Explanation is a little difficult to understand, but includes critical components.	Explanation is difficult to understand and is missing several components OR was not included.
Completion	All problems are completed.	All but 1 of the problems are completed.	All but 2 of the problems are completed.	Several of the problems are not completed.
Neatness and Organization	The work is presented in a neat, clear, organized fashion that is easy to read.	The work is presented in a neat and organized fashion that is usually easy to read.	The work is presented in an organized fashion but may be hard to read at times.	The work appears sloppy and unorganized. It is hard to know what information goes together.

Seventh Grade Algebra
Performance Descriptors

Advanced	**Seventh grade students performing at the advanced level:** • simulate situations using 1st degree algebraic statements using the set of whole numbers, in order to justify solution(s); • model and solve multi-step problems involving rates and justify the reasoning; • write the inequality statement.
Proficient	**Seventh grade students performing at the proficient level:** • write, simplify, and solve 1st degree algebraic statements using the set of whole numbers; • model and solve multi-step problems involving rates; • identify and graph ordered pairs on a coordinate plane and inequalities on a number line.
Basic	**Seventh grade students performing at the basic level:** • simplify and solve one-step 1st degree algebraic statements using the set of whole numbers; • find unit rates; • graph ordered pairs in Quadrant I on a coordinate plane.

Seventh Grade Algebra
ELL Performance Descriptors

Proficient	**Seventh grade ELL students performing at the proficient level:** • write and simplify algebraic expressions using whole numbers; • solve equations involving inverse operations using whole numbers; • read, write, and speak the language of algebra.
Intermediate	**Seventh grade ELL students performing at the intermediate level:** • simplify algebraic expressions using whole numbers; • solve equations using replacement sets; • create numerical expressions from oral or written contexts using addition and multiplication; • explain in mathematical terms the sequence of steps used in solving problems; • give simple oral or written responses to directed questions on topics presented in class.
Basic	**Seventh grade ELL students performing at the basic level:** • simplify algebraic expressions using replacement values; • use a number line to solve problems that involve integers; • recognize and use basic algebraic terms; • respond to yes or no questions and to problems presented pictorially or numerically in class.
Emergent	**Seventh grade ELL students performing at the emergent level:** • respond to numerical (not word) problems using addition, subtraction, multiplication, and division; • copy and write numerals and algebraic symbols; • imitate pronunciation of numbers and mathematical terms; • use non-verbal communication to express mathematical ideas.
Pre-emergent	**Seventh grade ELL students performing at the pre-emergent level:** • observe and model appropriate cultural and learning behaviors from peers and adults; • listen to and observe comprehensible instruction and communicate understanding non-verbally.

COST OF GAS

Student Work Samples

As you examine the samples, consider the following questions:

- In light of the standard/s addressed and the assessment tools provided, what evidence does the work provide that students are achieving proficiency in the knowledge and skills addressed by the standard/s for the task?
- Is the task/activity well designed to help students acquire knowledge and demonstrate proficiency? Is the task/activity clearly aligned with the standards? In what ways would you adapt the task/activity to better meet the needs of your students?

Cost of Gas:

For my car, I chose a 2001 Honda Civic. This little car goes about 50 miles per gallon. From my house to the mall is roughly 18 miles., which would make it roughly 36 miles per day, since I have to go to and from. Gas is $1.76 per gallon, and I will only need about 1 gallon a day.

I've decided to take Interstate 90, then take an exit at 396A. This route seemed to have less traffic and took me less time to get to my destination. I could've also taken hwy. 38, turned on Wall Lake Road, then followed 12th street down to I-90, then turned on 41st St. This route was a lot longer and had lots more traffic and road construction.

For November my work schedule is…

Week 1(Nov.1-7)- work on Monday Wednesday, and Friday for 3 hrs; 4:00-7:00 p.m., then on Saturday and Sunday for 4 hrs;12:00-4:00 p.m.

Week 2(Nov.8-14)- work Mon, Wed, and Fri, for 3 hrs; 4-7 Thursday is Veterans Day, day off, and Friday is your day off. Saturday you work for 6 hrs; 12-6 p.m., and Sunday you work for 5 hours, 1-6 p.m.

Week 3(Nov. 15-21)- Same as Week 1.

Week 4(Nov. 22-28)- Same as Week 2.

Nov. 29th and 30th - work each day for 3 hrs; 4-7 p.m.

With this I have concluded that I have worked 20 hours each of the 4 weeks, and 6 hours on November 29th and 30th. So, the total is 86 hours for the whole

month of November. Since I work for minimal wage, I work for $5.15 per hour. So that would be 86 hours,x5.15=$442.90 per month.

At the Kum N Go gas station, they charge $1.76 per gallon. I drive to work 24 days out of 30. So, 24 days times the 36 miles that I travel a day, =864 miles per month. Then divide that by 50, which is the miles per gallon, and it equals 17.28 gallons of gas. Then 17.28 gallons that you use per month, times $1.76 per gallon= $30.41. So, you spend $30.41 per month on gas. Since your total monthly paycheck is $442.90, you spend $30.41, or about 6.8% of your paycheck on gas,(You can find this by taking 30.41 and dividing it by 442.9, which equals .068661097, and move the decimal 2 places to the left, and you have 6.8, or 6.8% and that's your percentage).

Sample #1 - Page 3

Calendar for November 2004 (United States)

<October | All of year 2004 | December>

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1 work 3hrs.	2 work 3hrs.	3 work 3hrs.	4 work 3hrs	5 Day off!	6 work 4hrs.
7 20h total work 4hrs.	8 work 3hrs.	9 work 3hrs.	10 work 3hrs.	**11** Veterans Day! Day off	12 Day off!	13 work 6hrs.
14 20h total work 5hrs.	15 work 3hrs.	16 work 3hrs.	17 work 3hrs.	18 work 3hrs.	19 Day off!	20 work 4hrs.
21 20h total work 4hrs.	22 work 3hrs.	23 work 3hrs.	24 work 3hrs.	**25** Happy Thanksgiving Day off!	26	27 work 6hrs.
28 20h total work 5hrs.	29 work 3hrs.	30 6h work 3hrs.				work 24/30days

Holidays and observances: 11: Veterans Day, **25**: Thanksgiving Day

☆- Every Friday is your "day off."
☆- Every Holiday you have off
☆- Mondays - Thursdays you work from 4:00pm - 7:00pm
☆- Sat & Sun - you work from 12:00 - 4:00pm
☆- Holiday weeks for Sat & Sun = Sat - 6hrs.; 12:00pm - 6:00pm
Sun - 5hrs; 1:00 - 6:00pm

http://www.timeanddate.com/calendar/custom.html?country=1&typ=1&year=2004&month... 11/23/04

Looking at Student Work – Instructor notes and rating for work sample #1:

Student scored an advanced rating using the rubric for this performance task. A thorough understanding of the algebra standard and the overall task was accurately displayed. Explanation was thorough and precise.

Student Work Sample #2

Cost of Gas Project

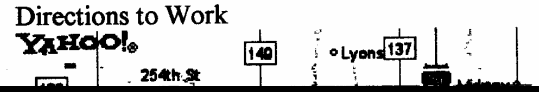
Due to the fact that minimum wage is $5.15 an hour multiplied by three hours of work a day equals $15.45 a days pay. Multiply that by 28, the amount of days you would work in a month. It would be $432.60 a months pay.

. The amount of miles I would need to travel in one month is 1,736. Divide that by average mils per gallon and that would be the amount of gallons I would need in one month. I would need 83 gallons of gas in one month. Multiply that by the gas price and there would be the amount of money for gas I would need in one month. I would need $156 for gas in one month. Divide $432.60 by $156 and there would be the percent of

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	4:00-7:00	4:00-7:00	4:00-7:00	4:00-7:00	4:00-7:00	4:00-7:00

money I would need for a month's worth of gas. 27% of months pay goes into it.

Directions to Work



Looking at Student Work – Instructor notes and rating for work sample #2:

This is an example of a basic performance score using the rubric for this performance task. Student shows no real explanation that they understand the Algebra Standard of modeling and solving multi-step problems involving rates. Some of the calculations are explained incorrectly and others are not clear where they were derived from. A map from MapQuest (which was removed from this project example to protect student's privacy) showed only one route and no explanation as to why they chose that particular route.

INSTRUCTIONAL NOTES

Author Comments
The students really got into this task, especially choosing their car. Reminders to stay on task and not lose sight of the project goal were needed until car was chosen. This was a relevant project to them and many were eager to orally present their completed task to the group.

Task Extensions
Modifications to this task could be to select a car for the students and give them the estimated gas mileage, have them use the newspaper want ads to find a car, provide them with the number of miles it is to their place of work, give them a cost of a gallon of gas, provide them with their wages, etc.

Common Strategies
Most student went right to internet to find their vehicle, estimated mileage, child labor laws (which they found there was some differences in web sites), maps, etc., but this task could be completed without internet access.

Common Misunderstandings
No real misunderstandings observed. Very few questions as to what was expected.

Resources

SD Mathematics Content Standards
http://www.doe.sd.gov/contentstandards/math/index.asp
SD Assessment and Testing
http://www.doe.sd.gov/octa/assessment/index.asp
The National Assessment of Educational Progress (NAEP)
http://www.doe.sd.gov/octa/assessment/naep/index.asp
National Council of Teachers of Mathematics
http://nctm.org/
Looking at Student Work
http://www.lasw.org/index.html